

Uncle Sam's Wizard of Metallurgy Refuses Fabulous Wealth

With Money Pouring In Upon Him
Dr. Cottrell Diverts Golden Stream
to Benefit Struggling Scientists

By ALBERT WHITING FOX.
THERE is a man working for a modest government compensation who to-morrow could command a salary which would make the earnings of a popular movie star look like pin money. He could announce his readiness to give his services exclusively to one concern and have the directors of American steel companies, copper companies, zinc companies, etc., hurrying here ready to outbid each other in big round, substantial figures. Dr. Frederick G. Cottrell, chief metallurgist of the Bureau of Mines, is the man in question. The story of his career, the results he has achieved and the rapidly accumulating benefits which the nation is getting from his work form a striking romance of science.

A little more than ten years ago Dr. Cottrell was a poorly paid, struggling assistant professor of chemistry in the University of California. Now he has saved his plants in the country literally millions of dollars, has found a means of giving the United States a potash supply independent of Germany, has been responsible largely for the development of the non-inflammable gas helium of inestimable military and commercial value, and stands out as such an undisputed leader in his line that he was awarded the Perkin medal for 1919 by the Society of Chemical Industry "in recognition of his most original and valuable work in applied chemistry."

Diverts Golden Stream.
Only in the matter of financial recompense has Dr. Cottrell remained backward. He has consistently refused all offers to make a fortune out of his work, and when money began to pour in upon him in spite of himself he promptly got his friends together, formed what is known as the "research corporation," turned the financial stream into the corporation with the provision that the funds were to be used to assist struggling scientists whose hardships he already knew. An ironclad agreement has been made that all profits from his work go to the corporation and not to Mr. Cottrell himself.

No one would imagine from his manner or appearance that Dr. Cottrell had already risen to the top rank among the scientists of the world. There is nothing about him to suggest the popular conception of the great scientist. He looks like the typical wide-awake American business man of 49, who has no fads and believes in the free and easy unconventional way of meeting men with whom he comes in contact.

After luncheon with him at the club one might say that his particular interest was in how to care properly for an automobile or in billiards. At present Dr. Cottrell is making a flying trip to Europe in connection with helium developments.

The first big contribution of Dr. Cottrell to science was the electrical precipitation of particles of liquids and solids, or, in popular terms, the elimination of smoke and rescue of smoke constituents by a process of electricity. Undertaken first to eliminate smoke as a nuisance, the process showed that the so-called smoke dust precipitated at big plants was worth in some cases more than the product being manufactured.

It was in 1906 while he was working as assistant professor of chemistry at the University of California that the idea first came to Dr. Cottrell. California at that time was much annoyed over fumes from smelters. There were examples of it close to the university. The fumes were admittedly necessary to the running of the smelters, but were a nuisance to every one within their radius. There was continued talk about it, but no one suggested a possible remedy, excepting to remove the smelters.

Spring His Surprise.
Dr. Cottrell said little, but it was noticed that he began spending all his spare time in the laboratory. He worked whenever he got a chance during the day and far into the night. Finally he surprised his friends at the university by telling them that he had discovered an "electrical precipitation process" which would do away with the smoke.

In a general way his idea was to remove the suspended particles from the gases by the aid of electrical discharges. His process was to operate by passing the gases, carrying the suspended, finely divided particles, between two systems of electrodes, one of which was made to carry a negative electrical charge, while the other carried a positive charge.

The electrodes were to be charged by being connected with a source of high voltage electricity, consisting of a high voltage transformer for increasing the electric potential up to a working voltage of from 20,000 to 100,000 volts. A rectifier for changing alternating current into direct current and a switchboard were to provide the necessary control equipment. Dr. Cottrell figured that the suspended particles while passing between the electrodes would become electrically charged and would be driven into pipes by the forces of the electric field.

The professors at the university believed in Cottrell and were interested in his announcement, although they all agreed that nothing could be done with it without money.

Cottrell had no money. He was distinctly "hard up" in those days, but he was certain he could eliminate the smoke nuisance if given a chance. He obtained the personal and financial assistance of Prof. Edmund O'Neill of the chemistry department and Dr. Harry East Miller and E. S. Heller, both alumni of the university. This put him in a position where he could attempt to get some of the smelting companies interested, but his efforts along this line were either not taken seriously or were ridiculed.

"There's a smoke bug up in the university," was the only comment heard which even indicated to Dr. Cottrell that his presence was known by the men running the smelters. Strangely enough this "smoke bug" was to play an all important part in the developments of the future.

It happened that the Riverside Portland Cement Company, near Riverside, Cal., was having all manner of trouble with the orange groves in the vicinity. Dust blown out of the stacks from the rotary kilns was settling in the buds and killing the crops. The orange growers had taken the matter into the courts and were spending hundreds of thousands of dollars in pressing and winning their cases.

The company bought up the land at \$1,000 an acre and then found it could not stand the pace. More than \$1,000,000 had already been spent by the company in litigation and still there was no relief in sight. The directors were desperate. In the course of one morning somebody repeated the story about the "smoke bug" at the university and the directors said, "Bring him to us."

Dr. Cottrell went to the company's plant and installed his process. It worked like a charm. His process did away with the smoke and collected approximately 100 tons of dust per day.

His presence at the plant gave him an opportunity to get acquainted with the men running the business. They found him interesting and full of suggestions designed to help them.

The mill had a capacity of 5,000 barrels of cement a day and business was good, but Dr. Cottrell told them they might find it profitable to examine the smoke dust, which was coming in at the rate of 100 tons a day. He figured that there might be profitable

potash values contained in this dust. The company took his advice and investigated. Now the Portland Cement Company is manufacturing chiefly potash, obtained from the smoke dust by the Cottrell process, and is only making cement as a by-product. A new and profitable means of getting potash had been discovered.

A recent statement issued by the Bureau of Mines here bears on this point of Dr. Cottrell's work. It is as follows:

"In the attempts of the United States to find some methods of increasing the potash production for fertilizers and other purposes to offset the stoppage of shipments from Germany there has come to the attention of the Bureau of Mines, Department of the Interior, a highly successful effort at the plant of the Riverside Cement Company, Riverside, Cal.

"This company, after a number of years of costly litigation with the



FREDERICK G. COTTRELL
CHIEF METALLURGIST
U. S. BUREAU OF MINES

His Development of Helium and U. S. Supply of Potash Marks Striking Romance of Science

orange groves in the territory adjacent to the plant, because the dust discharged large quantities of dust that fell on the groves, installed the Cottrell electric precipitator with the sole hope of abating the nuisance.

"Word now reaches the Bureau of Mines that the factory of this cement company on March 1 went into full blast operation for the purpose of making potash, with cement as a by-product. The investigator who reported many details of this operation of the plant to the bureau says:

"This is certainly a romantic development of modern industry, where an apparatus installed for the purpose of saving the life of the factory turns out to be the center of operations, around which the entire plant is adjusted, the incidental profits being sufficient, at least during the continuance of the war, to make the former operation of the factory of secondary importance."

But if one plant can make potash in this way, why not other plants? The Bureau of Mines asked. How about blast furnaces, the smelting plants, where the dust contains potash as it does in most cases?

Promises Plenty of Potash.

The United States Government now feels assured that by means of Dr. Cottrell's discovery America will have more than enough potash for its own needs without depending on Germany or any other outside source. In a statement issued on October 3 last Secretary of the Interior Lane said definitely:

"The United States does not need German potash. America can in two years become entirely independent of Germany in this regard by the development of her own deposits and the use of processes devised by Dr. Cottrell of this department."

Among the plants already using the Cottrell processes are the American Smelting and Refining Company at Garfield, Utah; Maurer, N. J.; Omaha, Neb.; the American Steel and Wire Company at Worcester, Mass.; the Anaconda Copper Mining Company at Anaconda, Mont.; the Ballou Smelting and Refining Company at Newark, N. J.; the Minnesota Steel Company at Duluth, Minn.; the Raritan Copper Works at Perth Amboy, N. J.; the Rome Brass and Copper Company at Rome, N. Y.; the Winchester Repeating Arms Company at New Haven, Conn., and others too numerous to mention.

The assets of the research corporation, of which men like Charles D. Walcott, secretary of the Smithsonian Institution, and Otto H. Kahn are directors, jumped to \$217,852.72 from royalties on Dr. Cottrell's invention as soon as it was fairly started. More money is coming in than the corporation knows what to do with, but Dr. Cottrell is convinced that new scientific discoveries can be helped along by financial assistance from discoveries already made. That is his slogan.

Development of Helium.

Other important work has been done by Dr. Cottrell, but the value of the right man in the right place has been particularly emphasized by the development of the new non-inflammable gas helium.

The idea of using helium in balloons, dirigibles, etc., is that it has practically the same lifting power as hydrogen, but unlike hydrogen cannot be set afire. It makes the balloon and dirigible safe against explosive bullets. It is the airship's defense against the incendiary bullet just as armor was the defense of the old wooden ships against cannon.

The military authorities dread to think what would have happened if the Germans had had helium instead of hydrogen in their Zeppelins during the London and Paris raids.

It was during one of the Zeppelin raids over London that the first move toward developing helium started. An old British scientist fell to thinking what would happen if the Zeppelin could not be set afire. He remembered having put away an old report made some ten years ago by a Prof. Cady of the University of Kansas which claimed that helium could be found in the ground in Oklahoma and Texas. He got the report out and sent it to the Admiralty.

The British experts decided that if there was one chance in a thousand to get anything of that sort it was worth taking, so they communicated with the Government of the United States and sent experts over. The experts were referred to the Bureau of Mines, and Director Manning of the bureau in turn referred them to Dr. Cottrell. Then things began to happen.

Dr. Cottrell Gets Busy.

Dr. Cottrell brushed aside all sceptical suggestions as to why the plan would not work. "We are not here to find out why it won't work, but to make it work," he said, and forthwith he started setting the wheels in motion.

It is not easy to cut red tape and get action out of the executive departments in Washington. In this case the War Department and the Navy Department, as well as the Bureau of Mines, were concerned. It was necessary to keep these three branches working and it was necessary to get money from Congress without telling Congress what the funds were needed for, as it was a deep war secret.

The theory advanced for the quantity production of helium seemed to Dr. Cottrell sound. In a general way it consisted of a process similar to liquefaction of air, everything except helium was to be liquefied out, which was possible because it required 268 degrees centigrade below zero to liquefy helium, and other gases went out before that was reached. To Dr. Cottrell there seemed no difficulty in the practical application which could not be surmounted, excepting the danger of not getting red tape cut and delay and inactivity done away with.

He set out to force action and haunted the offices in question until he became the "helium bug," which reminded him of his former "smoke bug" title. But he kept after results and managed to cut enough red tape to get things started.

As for getting money from Congress the Bureau of Mines began to plead for an appropriation for important experiments in "argon," this being the camouflage name for helium. Congress did not know what was going to be done with argon, but Dr. Cottrell saw some of the Congressmen and the money was forthcoming. Now helium is being produced in quantity at two big plants in Texas.

Songs Sung by New York City's Own in Camp and on the March

THESE are the real war songs of the Seventy-seventh Division, New York City's Own—the songs that sprang up of themselves, in camp, on the march, as genuine soldier songs generally do. THE SUN is indebted for the words to Capt. J. M. Loughborough.

SENDING THEM OVER.
You keep sending them over; we'll keep knocking them down.
Planting them under the clover, six feet under the ground.
Send every Hun, no matter how tall; The bigger they come, why, the harder they fall.

VERDIE AND ARGONNE.
(Tune: "Lord Geoffrey Amherst.")
The Three-O-Four Artillery that hails from old New York
Is a regiment that anybody knows—
For we started down in Upton in September, '17,
And we lived through the Yaphank snows—
Yes, we lived through the Yaphank snows—
Then off across the ocean we were shipped with all our men.
They were soldiers loyal and true,
And we shot up the Hunns that ever came within our sight,
And we looked around for more when we were through.

CHORUS:
O the Verdie and the Argonne,
They were names known to fame in days
Now forever made glorious
Of you-ore!
By the fighting of the Three-O-Four,
But now the war is over, for the Dutchmen had enough—
Yes, too much if the truth be told;
Of our screaming high explosives and
All the world knows they're laid out cold—
And the world's glad they're laid out cold—
And for our gallant regiment, among the first to fight,
There's a big time coming some day—
When the ocean's ferry get around to carrying us home
And we sail past the Statue up the Bay.
(Chorus as before.)

MATERIEL.
(Tune: "When I Get You Alone To")
When we get our materiel,
Then the horses can go to hell.
When we slip into high how the old dust will fly!
Chug, chug, chug—watch us go by!
When we slip them the first big shell
How those Germans will run and yell—
They will wish they were four-point-eves,
When we get our materiel!

CHORUS:
Caterpillars will pull us through;
There is nothing they cannot do—
With a great many clanks we'll shoot past the tanks!
Chug, chug, chug—just watch the tanks!
Yanks!

We will shoot up the bloody Hun
As it's never before been done.
All the Boches will hit the timber
When they see our first number—
With our brand new materiel!

REGIMENTAL HISTORY.
Oh, first we went to Baccot to learn to
And all we did was eat and sleep; we
never worked the guns;
The Germans never fought by night,
When they were first fought by day—
A quiet place to learn to fight was up
in Rehberly!

CHORUS.
Home, boys, home, it's home we ought to be,
Home, boys, home, in the land of liberties.
For the ash and the oak and the sour apple tree
They all grow together up in North America!

77th's Brave Record Crowned by Victory in the Argonne Forest
Continued from Fourth Page.

With a dozen brother officers I had been ordered to a Lewis gun school at Lumbra, near St. Omer. While there, apart from becoming almost chummy with the French, I had learned the following noteworthy things:

That one flushes, rather than blanches, when badly scared.
That the French peasant is amazingly adapted to living calmly under shell fire.
That the English officer is too darn reckless.
That Ireland wants, very much, her freedom.

While there seems to be little connection between the four propositions one flows from the other as naturally as a thin stream of red wine from a goatskin canteen to a polka's mouth. It happened in this way:

One Sunday afternoon—Sunday being a half holiday—Lieut. Charles Greenwood and I induced a young Irish subaltern from an Irish regiment to take us, sub rosa, on a free-lancing trip to the front.

Oh, then we went to Farm des Dames, across from old Banoche
And took up a position for to harram Henry Boche.
But Henry Boche was night and day and gassed us in between—
As hot a spot was Farm des Dames as any I have seen.

Then we went across the Vesle and hit the doughboys tried to catch the Hun, but he was on his way.
But when we settled in the town he called us to a dot.
And every time he wanted to be dropped one on the spot.

Then the Wops relieved us and we went south by west.
And hiked from Plaines to Menchehold with never any rest.
We took up a position on a hill above Chalsade
With all the big and little guns the U. S. Army had.

Then we fought the Argonne, from Harree to Grandpre,
And took in Abri Crochet and La Viergette on the way—
We showed the Hun some fighting and some brand new Yankee tricks,
Then we handed Heinke's number to an outfit from Camp Dix.

Then we all were granted leave and hit the trail for home.
The sergeant tells the corporal when he has cause to hope,
And still we practice fighting and liaison in the mud.
And every rumor that we get turns out to be a dud.

Oh, now the war is over and we'll soon be safe at home,
All sitting in Husbands' and blowing off the foam.
The Germans fought a dirty war and raised a lot of hell,
But when they got the Yankees goat, then they were S. O. L.

The Second started hell for leather riding over France,
They tried to catch the Infantry, but never had a chance;
McDougal got a section up and got it damn well hit—
And then the Boche decided it was time for them to quit.

We got a lot of rumors and we hear the trail for home,
The sergeant tells the corporal when he has cause to hope,
And still we practice fighting and liaison in the mud.
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Oh, now the war is over and we'll soon be safe at home,
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WHAT D'YE MEAN?
What d'ye mean you stayed too long in Paris?
What d'ye mean you took an extra day?
Your little card told you what to do,
You know the one I mean, that little square of blue.

What d'ye mean you stayed too long in Paris?
What d'ye mean you wouldn't let us go?
Three months that you got for that?
Just took that under your overseas hat!
What d'ye mean you stayed too long in Paris?

What d'ye mean that you missed your train?
What d'ye mean by walking on the winter wheat?
What d'ye mean you don't obey commands?
We strive to please the French authorities, too.

And you come along and gum the whole damn mess.
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